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## (54) IMPROVEMENTS IN OR RELATING TO LUMINOUS INDICATOR SYSTEMS FOR GROUP CHANGE SPEED GEAR BOXES

(71) We, ROBERT BOSCH GMBH., a German company of Postfach 50, 7 Stuttgart 1, Federal Republic of Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to luminous indicator systems for group change change speed gearboxes which are used in motor vehicles and which are equipped with a selector lever for selection of a gear group.

In motor vehicles having group change change speed gear boxes, particularly in heavy commercial vehicles, the driver can generally choose between a lower gear group and an upper gear group. By way of example, when the lower gear group is engaged, gears 1 to 3 can be engaged by means of a gear lever, and gears 4 to 6 can be engaged when the upper gear group is engaged. Change-over from one gear group to the other is generally effected by actuating a selector lever or knob mounted on the gear lever. A change over from one gear group to the other generally requires a longer period of time than does a change from one gear to the next within a gear group. Therefore, it is desirable that an indication of which gear group is engaged at any given time should be available in order to avoid damage to the gearbox by prematurely letting-in the clutch and changing the gears.

It is known to associate a luminous indicator with each gear group in a group change change speed gearbox and to indicate the prevailing state of actuation by the illumination of a lamp corresponding to the gear group engaged. A disadvantage of these luminous indicators is that the driver of the motor vehicle cannot sense the duration of the change-over operation from one gear group to the other, and that luminous indicators of this type hitherto could only be realised by electro-mechanical methods.

According to the present invention a luminous indicator system for a motor vehicle group change change speed gearbox having an associated gear group selector lever for the selection of at least two gear groups comprises a first set of at least two switching contacts associated with the gear group selector lever and each adapted to be engaged when the selector lever is actuated to select and initiate engagement of a respective gear group, a second set of at least two switching contacts disposed in the gearbox and associated with the respective gear groups and each adapted to be engaged when engagement of a respective gear group has been completed, at least two luminous indicators associated one with each gear group, and an electronic circuit including the first and second sets of switching contacts and the luminous indicators to control energisation of the luminous indicators to give visual indication of which gear group is engaged and when a change of gear group is in progress.

A luminous indicator system embodying the present invention for group change change speed gearboxes, has the advantage that it can indicate the duration of a change-over operation from one gear group to another. The electronic circuit can be constructed in a simple manner and with great operational reliability from commercially available components. Thus, the driver is able to adjust the gear-change and clutch operations accurately to the change-over characteristic of the group change change speed gearbox, thus protecting the gearbox and the clutch.

In a preferred embodiment, the gear group engaged is indicated by illumination of an associated lamp, provided that the selector lever is in the position correspond-

ing to that gear group. If the selector lever is put into a position corresponding to a different gear group, the lamp corresponding to the selected gear group flashes until the engagement of the selected gear group is indicated by switching contacts located in the gearbox, and then only the lamp corresponding to the gear group now engaged group is illuminated continuously.

Preferably an astable multivibrator is employed for producing the flashing light. The multivibrator is of purely electronic construction and avoids the disadvantages of mechanical flasher units.

The invention will be further described by way of example with reference to the accompanying drawings which is a single figure showing a basic circuit diagram of a luminous indicator system in accordance with one embodiment of the invention, and having an astable multivibrator used as a flasher unit.

Referring to the drawing a circuit of a luminous indicator system in accordance with one embodiment of the invention is supplied by way of a supply lead 1 which is connected to an operating voltage supply by way of a terminal 2, and by way of an earth lead 3 which is connected to earth by way of a terminal 4. A protective diode 5, acting as a protection against connection with incorrect polarity, is located in the supply lead 1. A series combination comprising a resistor 61, the switching path of a transistor 62, and a first lamp 63, is connected between the supply lead 1 and the earth lead 3. The base of the transistor 62 is connected to the supply lead 1 by way of a resistor 64, which is bridged by two diodes 66, 67. The base of the transistor 62 is connected to a resistor 65 which is connected to a switching contact 110 of a second group switch 11 connected to the earth lead 3. The switching contact 110 of the second group switch 11 is connected to a coupling diode 68 which, by way of a resistor 12 and a series diode 16, is connected to a switching contact 101 of a first group switch 10 connected to the supply lead 1. The junction between the resistor 12 and the diode 16 is connected to the output of an astable multivibrator 6 by way of a resistor 13. A transistor 72, a resistor 71, a second lamp 73, a resistor 74, a resistor 75, diodes 76, 77 and 78, a resistor 14, a resistor 15 and a series diode 17 are connected in a corresponding manner and are connected to a switching contact 111 of the second group switch 11 and to a switching contact 100 of the first group switch 10 and to the astable multivibrator 6. A first solenoid valve 20 and a quenching diode 21, and a second solenoid valve 30 and a quenching diode 31, are connected between the switching contacts 100, 101 of the first group switch 10 and the earth lead 3. In a known manner, the astable multivibrator 6 comprises transistors 81 and 82, resistors 83 to 86, 89 and 90, capacitors 87 and 88 and diodes 91 and 92. A diode 93 is connected in the collector lead of the transistor 82. The bases of the transistors 81 and 81 are interconnected by way of a RC circuit comprising a resistor 94 and a capacitor 95.

The first group switch 10 is connected to the gear group selector lever of the motor vehicle and permits a change-over from a lower gear group, corresponding to the switching contact 100, to an upper gear group, corresponding to the switching contact 101. The first solenoid valve 20 for the upper gear group, or the second solenoid valve 30 for the lower gear group, is energized according to the position of the first group switch 10. The second group switch 11 is located in the gearbox and is actuated when engagement of the selected gear group has been completed. If the lower gear group has been engaged, the first group switch engages switching contact 100, and the second group switch engages switching contact 110, and, if the upper gear group is engaged, the first group switch engages switching contact 101 and the second group switch engages switching contact 111. With the switches engaging these contacts, the lamp corresponding to the particular gear group engaged should be switched on and the other lamp should be switched off. The first lamp 63 is associated with engagement of the lower gear group, and the second lamp 73 is associated with engagement of the upper gear group. If a change-over is now effected at the first group switch 10 from one gear group to the other, for example from the lower gear group to the upper gear group corresponding to a change-over from switching contact 100 to switching contact 101, the first lamp 63 continues to be lit up in the first instance and the lamp 73 commences to flash. This state lasts until the upper gear group has been engaged in the gearbox and the termination of the engaging operation has been signalled by the changing over of the second group switch 11 from switching contact 110 to switching contact 111. The first lamp 63 is then extinguished and the second lamp 73 is lit up continuously. In this manner, change-over from one gear group to the other has been signalled by illuminating, flashing and extinguishing two lamps (63, 73).

In the basic circuit diagram shown in the drawing, the first group switch 10 engages switching contact 100, and the second group switch 11 engages switching contact 111. This means that a group change-down from the upper gear group to the lower gear group has been initiated by actuation of the selector lever, although the engaging operation in the gearbox has not yet been

completed. Correspondingly, the first lamp 63 must be flashing and the second lamp 73 must be still illuminated.

The lamps 63 and 73 are switched by way of the transistors 62 and 72. The bases of the transistors 62 and 72 can be connected to the earth lead 3 by way of the resistors 65 and 75 by means of the second group switch 11. If this is the case for one of the transistors 62, 72, that transistor is switched on and the associated lamp 63, 73 is continuously illuminated. This applies to the second lamp 73 in the positions of the switches shown in the drawing. The base of the transistor 62 is connected to the output of the astable multivibrator 6 by way of the resistor 65, the coupling diode 68, the resistor 12, and the resistor 13. Since the switching contacts 101 and 110 are not engaged when the switches are in the positions shown in the drawing, the base of the transistor 62 is acted upon by the output of the astable multivibrator. The first lamp 63 thus lights up in synchronism with the relaxation oscillation of the astable multivibrator 6. The diode 78 prevents the relaxation oscillation of the astable multivibrator 6 from influencing the continuous illumination of the lamp 73. When the gear group change operation has been completed and the lower gear group has been engaged, the second group switch 11 switches over from switching contact 111 to switching contact 110. The potential of the base of transistor 62 is thus reduced, and the transistor 62 switches through and the first lamp 63 is continuously illuminated. At the same time the second lamp 73 is extinguished, since the potential of the base of transistor 12 is raised. However, the astable multivibrator 6 cannot cause the second lamp 73 to flash, since the junction between the diode 17 and the resistor 14, acted upon by the output of the astable multivibrator 6, has been effectively raised to the potential of the supply lead 1 by the first group switch 10.

The resistors 61, 71 and the diodes 66, 67, 76, 77 are provided to avoid damage to the transistors 62, 72 in the event of either of the lamps 63, 73 short-circuiting.

The mode of operation of the astable multivibrator 6 results, in a known manner, from the switching behaviour of the transistors 81, 82 which are back-coupled in a crosswise manner by the resistors 84, 85 and capacitors 87, 88. A diode 93 is provided to improve the rectangular edges of the switching pulses of the astable multivibrator 6 and decouple the latter when the transistor 82 is blocked. An RC circuit, which comprises resistor 94 and capacitor 95, and which interconnects the bases of the transistors 81 and 82, acts to prevent the astable multivibrator 6 from being triggered by interference pulses.

Whilst the embodiment of the invention described is primarily for use with a two gear group change change speed gearbox having an upper gear group and a lower gear group, it will be apparent that the invention can be adapted for use with a gear group change change speed gearbox having more than two gear groups.

WHAT WE CLAIM IS:-

1. A luminous indicator system for a motor vehicle group change change speed gearbox having an associated gear group selector lever for the selection of at least two gear groups, comprising a first set of at least two switching contacts associated with the gear group selector lever and each adapted to be engaged when the selector lever is actuated to select and initiate engagement of a respective gear group, a second set of at least two switching contacts disposed in the gearbox and associated with the respective gear groups and each adapted to be engaged when engagement of a respective gear group has been completed, at least two luminous indicators associated one with each gear group, and an electronic circuit including the first and second sets of switching contacts and the luminius indicators to control energisation of the luminous indicators to give visual indication of which gear group is engaged and when a change of gear group is in progress.

2. A luminous indicator system as claimed in claim 1, in which the gearbox has two gear groups, and in which the luminous indicators comprise a first lamp associated with a lower gear group and a second lamp associated with an upper gear group.

3. A luminous indicator system as claimed in claim 2, in which the electronic circuit includes a flasher unit and responds to the first and second switching contacts such that, when in operation, when the position of the selector lever corresponds to the gear group engaged only the lamp associated with that gear group is energised, and when the selector lever is actuated to initiate a change of gear group the lamp associated with the selected gear group is energised through the flasher unit until engagement of the selected gear group has been completed.

4. A luminous indicator system as claimed in claim 3, in which the lamps are switchable by means of transistors of which the bases are connected to an operating voltage supply line by way of resistors and are connectible to earth by way of further resistors and the second switching contacts, and in which the second switching contacts can be connected to the operation voltage supply line by way of coupling diodes, resistors, series diodes and the first switching contacts.

5. A luminous indicator system as

claimed in claim 4, in which the output of the flasher unit is connected to the junctions between the series diodes and the resistors.

6. A luminous indicator system as claimed in claim 3, 4 or 5, in which the flasher unit is an astable multivibrator.

7. A luminous indicator system constructed and arranged and adapted to be operated substantially as hereinbefore particularly described with reference to and as illustrated in the accompanying drawing.

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1 SHEET *This drawing is a reproduction of the Original on a reduced scale*